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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/040,224 | 01/02/2002 | Ebrahim Andideh | 42390P11353 | 2917 |

8791 7590 11/01/2002

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EXAMINER

LEE, HSIEN MING

| | |
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| ART UNIT | PAPER NUMBER |
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2823

DATE MAILED: 11/01/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/040,224

Applicant(s)

ANDIDEH, EBRAHIM

Examiner

Hsien-Ming Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 August 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5-15, 17-24 and 26-30 is/are rejected.
- 7) ☒ Claim(s) 4, 16 and 25 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>3</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

Remarks

1. The objection to claim 13 is withdrawn in response to applicant's amendment filed 8/9/02.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

3. Claims 1-3, 5 are rejected under 35 U.S.C. 102(e) as being anticipated by Usami (US 6,222,269).

With respect to claim 1, Usami in Figs. 2A-2D, 3A-3D, 4A-4C and related text, expressly and inherently teaches the claimed method of forming a semiconductor device comprising:

- forming a first patterned conductive layer 3 on a dielectric material 2 on a substrate 1 (Fig. 2D);
- forming a first barrier layer 6 on the surface of the first patterned conductive layer 3 (Fig. 4A);
- forming a second barrier layer 7 on the surface of the first barrier layer 6 (Fig.4A);

- forming a dielectric layer 8/11 on the surface of the second barrier layer 7 (Figs. 4A and 4C); and
- forming a via through a first portion 8 of the dielectric layer 8/11 and through a first portion of one of the first 6 and second 7 barrier layers (Figs. 4B-4C).

With respect to claims 3 and 5, Usami further teaches claimed method comprising forming a trench (i.e. where upper interconnect lines 10 are filled) through a second portion 11 of the dielectric layer 8/11 if the via (i.e. the opening formed in the layer 8) is formed through the first portion 8 of the dielectric layer 8/11 (Figs. 4B-4C).

Grounds of Rejections

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-2, 13-14, 21-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Lamey et al. (US 5,045,870).

Referring to Figs. 1, 2B and related text, Lamely et. al. identically teach the claimed method of forming a semiconductor device comprising:

- forming a first patterned conductive layer 19 on a dielectric material 17/15/10 on a substrate 11;
- forming a first barrier layer 21 comprising silicon nitride (col. 4, lines 4-5) on the surface of the first patterned conductive layer 19;

- forming a second barrier layer 23 comprising silicon carbide (col. 4, lines 4-5) on the surface of the first barrier layer 21, wherein the first 21 and second 23 barrier are formed by PECVD (col. 6, lines 55-57);
- forming a dielectric layer 25 on the surface of the second barrier layer 23; and
- forming a via through a first portion of the dielectric layer 17/15/10.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1, 6-13, 15, 17-20, 22, 24, 26-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hussein et al. (US 6,365,529) in view of Lamey ('870).

Referring Figs. 1a-1h and related text, Hussein et al. teach the claimed method of forming a semiconductor device comprising:

- forming a first patterned conductive layer 101 on a dielectric material on a substrate 100, wherein the substrate 101 may include a dielectric material on the top surface of the substrate 100 (col. 3, lines 50-56);
- forming a barrier layer 102 (silicon nitride) on the surface of the first patterned conductive layer 101;
- forming a dielectric layer 103 on the surface of the barrier layer 102; and
- forming a via 107 through a first portion of the dielectric layer 103 and a trench 106 through a second portion of the dielectric layer 103.

Hussein et al. do not teach a second barrier on the surface of the barrier 102.

However, Lamey et al. in an analogous art teach forming a first patterned conductive layer 19; forming a first barrier layer 21 (silicon nitride) on the surface of the first patterned conductive layer 19; and forming a second barrier layer 23 (silicon carbide) on the surface of the first barrier layer 21.

Therefore, one of the ordinary skill in the art would have been motivated to modify Hussein's barrier layer 102 by forming an additional barrier layer (i.e. the second barrier, silicon carbide) on the surface of the barrier layer 102 (silicon nitride), as taught by Lamey et al., since by forming dual barrier layers (silicon nitride and silicon carbide) on the patterned conductive layer pinholes in one film will have very low probability of directly aligning to a pinhole in the second film, thus making a relatively impervious combined film structure (col. 6, lines 55-64, Lamey et al.).

Regarding claims 6, 7, 18, 27-28, the given teaching of Hussein and Lamey would form the via 107 through the second barrier (silicon carbide) followed by forming the via 107 through the first barrier layer 102 (silicon nitride) with a etch pass.

Regarding claims 8-10, 19-20 and 29-30, the thickness of the first and second barrier layer is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result

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effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Regarding claims 11-12, the given teachings of Hussein and Lamely et al. teach that the first 21 and second 23 barrier are formed by PECVD (col. 6, lines 55-57).

Allowable Subject Matter

8. Claims 4,16, 25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record, Lamey et al to US 5,045,870, teaches the claimed method as stated above except that the via is filled with a sacrificial light absorbing material comprising at least one of a dyed spin-on polymer and a dyed spin-on glass with dry etch properties similar to the dielectric layer.

Response to Arguments

10. Applicant's arguments filed 8/9/02 have been fully considered but they are not persuasive.

Applicant argues that Lamey does not teach the claimed limitation because the polyimide layer 25 forming on top of the second barrier layer 23 (silicon carbide) is not a dielectric layer.

Contrary to the argument, the polyimide layer of Lamey is a well-known dielectric material although Lamey does not literally use the word "dielectric" for the polyimide layer 25. In order to demonstrate the fact, the applicant is directed to review a US Patent No. 5,187,119, upon which the rejection has not relied. The Patent clearly states that "layers of a **dielectric**

such as a polyimide” (col. 1, lines 20-21). (emphasis added) Since Lamey **expressly and inherently** teaches all the claimed limitations as set forth in the previous Office Action and further comprise forming a via through a first portion of the dielectric layer 17/15/10 and through a first portion of one of the first 21 and 23 barrier layers, wherein the via is for the formation of a gold TAB 27 (Fig.2B), the 102(b) rejection as set forth in the previous Office Action is deemed proper.

Applicant also argues that there is no motivation or suggestion to combine the Hussein and Lamey because the layer above the barrier layers in two references are used for very different functions.

Contrary to the argument, Lamey reference is used to remedy the deficiency of the Hussein, wherein a second barrier layer is missing over the first barrier layer 102 in Hussein. By incorporating the second barrier layer as taught by Lamey over the first barrier layer 102 of Hussein (i.e. forming dual barrier layers on the patterned conductive layer) it would minimize the alignment of pinholes in one layer with respect to pinholes in the adjacent layer, thus making a relatively impervious multi-layered structure (col. 6, lines 55-64, Lamey et al.).

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after


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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-0142 for regular communications and 703-305-0142 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


Hsien Ming Lee
October 28, 2002


Olik Chaudhuri
Supervisory Patent Examiner
Technology Center (703-306-2794)